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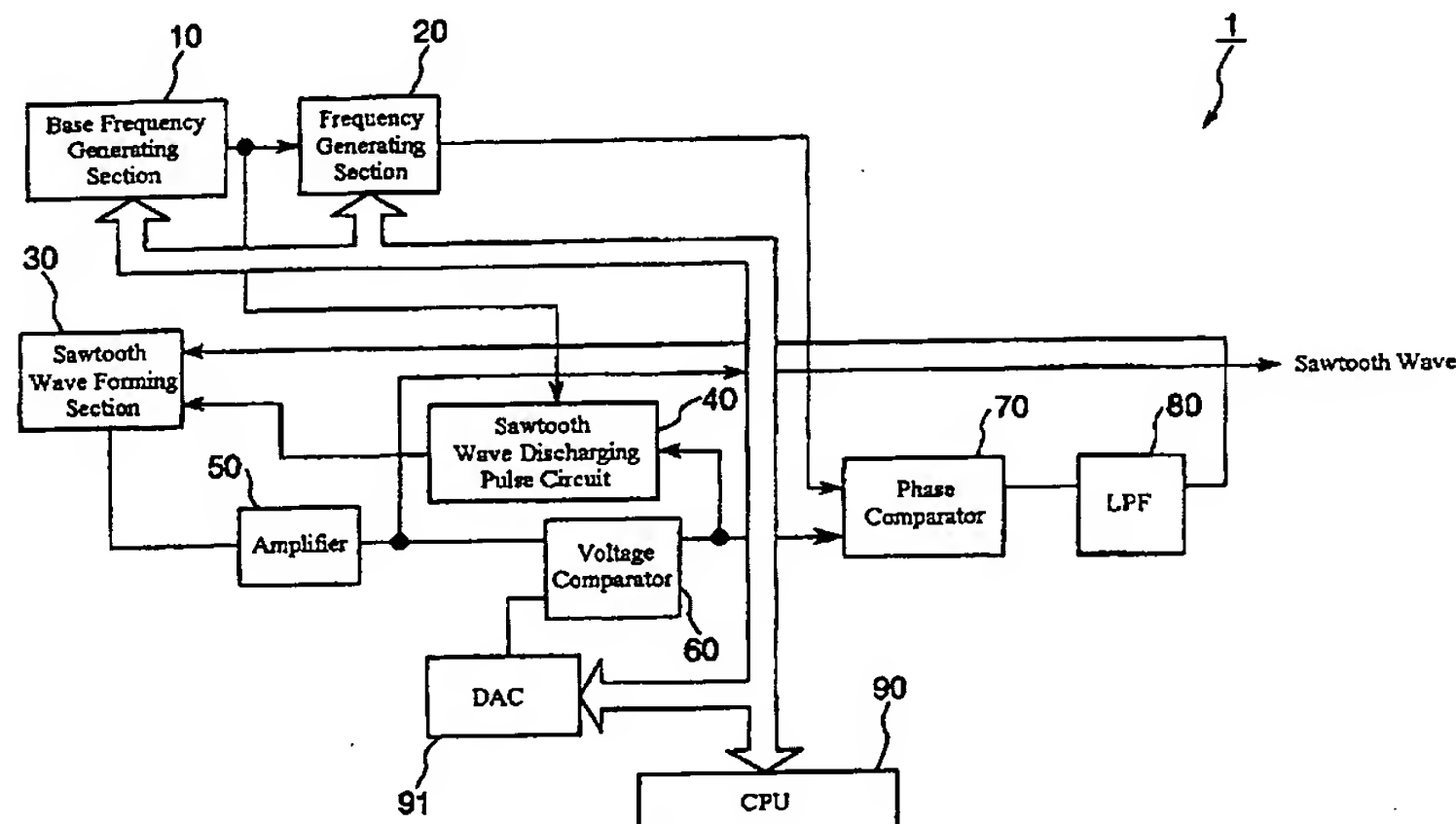
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- (71) Applicant (for all designated States except US): **SEIKO EPSON CORPORATION** [JP/JP]; 4-1, Nishishinjuku 2-chome, Shinjuku-ku, Tokyo 163-0811 (JP).
- (72) Inventor; and
(75) Inventor/Applicant (for US only): **TAKEUCHI, Ke-satoshi** [JP/JP]; c/o SEIKO EPSON CORPORATION, 3-3, Owa, 3-chome,, Suwa-shi, Nagano-ken 392-8502 (JP).
- (74) Agent: **ASAHI, Kazuo**; Nishi-Shinbashi Noa Building, 4th floor, 18-9, Nishi-Shinbashi 1-chome, Minato-ku, Tokyo 105-0003 (JP).
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(54) Title: A SAWTOOTH WAVE GENERATING APPARATUS, A METHOD OF GENERATING SAWTOOTH WAVE, A CONSTANT CURRENT CIRCUIT, AND A METHOD OF ADJUSTING AMOUNT OF CURRENT FROM THE SAME



(57) Abstract: A sawtooth wave generating apparatus 1 includes a base frequency generating section 10 and a frequency generating section 20 for generating the frequency of a reference signal, a sawtooth wave forming section 30 which forms a sawtooth wave based on the reference signal, a voltage comparator 60 which compares the voltage value of the sawtooth wave formed by the sawtooth wave forming section 30 with a predetermined voltage value, a phase comparator 70 which compares the phase of the output signal from the voltage comparator 60 with the phase of the reference signal, and a low-pass filter (LPF) 80 which cuts out a high frequency component of the output signal from the phase comparator 70, and feeds back the resulting output signal to the sawtooth wave forming section 30.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 455 493 A (PULLURU KISHAN R ET AL) 3 October 1995 (1995-10-03) column 2, line 24 - column 8; figures 1,2	1-3,5,7, 8,10,11
Y	-----	6,9
Y	EP 0 574 982 A (KONINKL PHILIPS ELECTRONICS NV) 22 December 1993 (1993-12-22) column 7, line 41 - column 8, line 34; figure 3 ----- -/--	6

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Cantarelli, R

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KNOPPER G J: "TRIGGERED SAWTOOTH GENERATOR" ELEKTOR ELECTRONICS, ELEKTOR PUBLISHERS LTD. CANTERBURY, GB, vol. 17, no. 191, 1 July 1991 (1991-07-01), pages 66-67, XP000235698 ISSN: 0268-4519 page 66, column 2, line 2 - right-hand column, line 1; figure 1	9
X	----- US 6 369 665 B1 (CHEE SAN HWA ET AL) 9 April 2002 (2002-04-09) column 2, line 54 - line 64 column 3, line 66 - column 6, line 62; figures 5-7	12,14
X	----- WO 93/24996 A (ANALOG DEVICES INC) 9 December 1993 (1993-12-09) page 5, line 2 - page 10, last paragraph; figures 1-5	1,4
X	----- DE 36 07 217 A (SIEMENS AG) 10 September 1987 (1987-09-10) column 2, line 49 - column 3, line 65; figures 1-3	1
X	----- US 6 147 550 A (HOLLOWAY PETER R) 14 November 2000 (2000-11-14) column 15, line 10 - column 16, line 2; figures 2,4	1
Y	----- US 5 469 092 A (ITAKURA TETSURO) 21 November 1995 (1995-11-21) column 9, line 3 - line 13; figure 24	13
Y	----- US 5 083 079 A (PLANTS WILLIAM C) 21 January 1992 (1992-01-21) column 4, line 22 - line 62; figure 2	13
X	----- US 5 083 079 A (PLANTS WILLIAM C) 21 January 1992 (1992-01-21) column 4, line 22 - line 62; figure 2	12,14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

JP 03/16823

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5455493	A	03-10-1995	NONE	
EP 0574982	A	22-12-1993	NL 9201053 A AT 162023 T DE 69316088 D1 DE 69316088 T2 EP 0574982 A1 ES 2113472 T3 FI 932694 A JP 6061803 A SG 48293 A1 US 5387882 A	03-01-1994 15-01-1998 12-02-1998 25-06-1998 22-12-1993 01-05-1998 16-12-1993 04-03-1994 17-04-1998 07-02-1995
US 6369665	B1	09-04-2002	NONE	
WO 9324996	A	09-12-1993	US 5283515 A EP 0642708 A1 JP 2629077 B2 JP 7503546 T WO 9324996 A1	01-02-1994 15-03-1995 09-07-1997 13-04-1995 09-12-1993
DE 3607217	A	10-09-1987	DE 3607217 A1	10-09-1987
US 6147550	A	14-11-2000	NONE	
US 5469092	A	21-11-1995	JP 3300534 B2 JP 7131256 A KR 159308 B1	08-07-2002 19-05-1995 30-03-1999
US 5083079	A	21-01-1992	EP 0397408 A1 JP 3102412 A	14-11-1990 26-04-1991